

Physiology
of Stammering.

Gas. Travis Whittaker.
April, 1876.

Satisfactory
A.T.

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None of the muscular actions of the human body, come more directly under the study of physiology than those concerned in the production of the human voice. Although none of the parts employed in speech and the production of musical sounds seem primarily designed, with the exception of the vocal cords, for this purpose, yet they subserve the end admirably. The great complexity of the muscular movements, the variety, quality and range of the sounds produced, the nicety of the physics involved, render the study of the human voice a most difficult subject, and one in which it is hopeless to attain to any comprehension without a thorough knowledge of the anatomy of the parts, the action of the muscles, the consistency and resistance of the vocal framework, the physical phenomena and effects - in a word, all that is included under the term - physiology of the human voice.

The Subject of Stammering does not by any means require us to go over the whole ground but to deal with a defect in the use of the vocal organs.

?
The habit of stammering is the forlorn hope of the elocutionist. The mere elocutionist has too slight a knowledge of anatomy and physiology to master this most difficult problem. His practice is empirical, and though he may be successful in improving comparatively simple faults, he will be quite at sea in the more difficult problems presented by the physiology of the human voice.

This will account, to some extent, for the fact, that the legitimate elocutionist does not challenge the problem - and it has been left to pretentious quacks to assert means of cure - means which contain some plausible glimmering of purpose, but which do not touch the question to the quick. One tells his pupil to keep the mouth closed till he is quite ready to form the word and project its sound from the vocal apparatus. Another's instruction is to draw in the breath before speaking - that is, to catch the breath; another recommends his pupil to expand the chest. One ~~who~~ recently visited this city, taking large fees for his method of cure. When divested of its mystery & importance woven round by his explanation - the secret was found to consist of a recommendation to press the nails into the palm of the hand at the moment of speaking.

The more legitimate elocutionists content themselves with a recommendation to cultivate the muscular powers of the chest, and ^{strengthen} the vocal organs by exercise and practice.

The above remarks, will, I hope, serve as an introduction to the consideration of this subject, guiding us in the immediate direction for its solution, and warning us at the same time, what to avoid.

The first observation, we make, then, is that in the production of a stammer there is necessarily no organic defect. It can be produced artificially or spontaneously. That is a non-stammerer can produce a stammer. The defect, therefore, is purely functional. We may supplement this by the way, with the remark, that stammerers, as a rule possess no other vocal defect. When he has overcome the spasmodic hesitation which keeps the word back - he pronounces the word correctly enough. The suggestion will probably rise that the cause of the defect is nervousness, or nervous weakness - this suggestion is satisfactorily dealt with further on.

Let us approach the subject with an experiment - let us see what conditions exist when stammer-

ing is produced artificially, that is, at will by a non-stammerer. It is not a difficult feat for most persons gifted with ordinary control over the vocal parts. In some, it has been asserted the facility has only been too easy, and the habit has been taken out of their control and become natural to them.

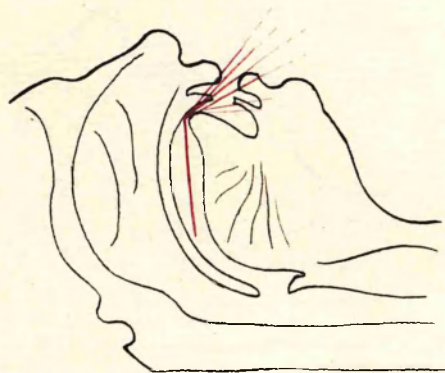
Note.- I may remark here, in passing, that few of us are conscious, from habit, of the position and efforts of the vocal parts, in giving forth the aggregations ^{of sound} which go to make up words. For instance in pronouncing any common word as "strength" we put the vocal parts, in rapid succession, into position to give six distinct sounds, as shewn in the accompanying sequence of diagrams. The first position represents the necessary configuration of the parts and the direction of the air-current to give the sound represented by the sign 's'. The tongue slightly hollowed is allowed to touch lightly by its up-curved edges the hard palate, just behind the ~~upper~~ incisors; the teeth and lips held slightly open so that a thin thread, or wire of air is projected against the flat surface of the upper teeth and thence guided against the sharp edge of the lower incisors - exactly after the manner of a steam whistle. The extremely rapid

Division - Fig 2 - represents the position for sound of "t" - the flattened tip of the tongue held forcibly against the hard palate, just behind the roots of the incisors. A powerful air-current cut off sharply as soon as the tongue separates, causes the sound of "t".

Now, let a person who has made himself conscious from observation, of the position of the vocal parts and the direction of the projected air currents, (as indicated in the note below) attempt to produce a shammer artificially. What does he find as the requisite

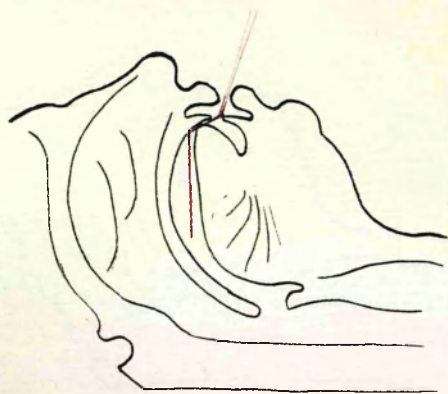
vibrations thus induced, produce the hissing sound of "s" - (Fig. 1.) Fig. 6 represents a modification of this letter, to produce the sound "th". The tongue flattened out is protruded to a very slight extent, between the teeth all round, dividing the mouth as it were by a floor. This floor guides the air current and diffuses it against the edges of the upper teeth, forming a broad and flattened "s". In those nations who have no "th", we notice the ^{sub}stitution of "s" for "th" sharp. A Highland servant girl in the house, constantly renders "Sabbath" as "Sabbas", while "South" is often rendered by the French and Germans as "Sous". The sound of "r" (Fig. 3.) is produced by bending the tongue like an elastic spring, tip ~~up~~ upwards, against the front of the hard palate. A powerful air current is now projected against the bent up tip, which forces it away, resulting in a lengthened explosion; its elasticity causes its return, again it is driven away. These rapidly repeated explo-

Fig. 2



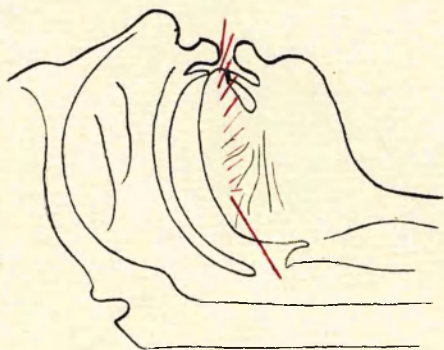
" t

Fig. 1.



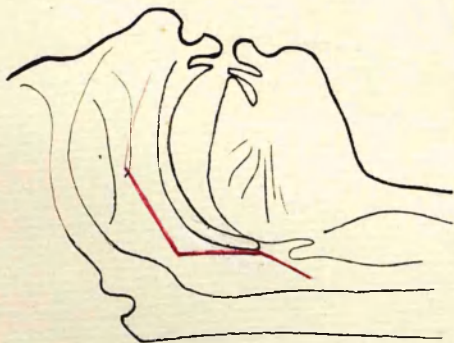
" s.

Fig. 6



"
th.

Fig. 5



"
ng

Fig. 10.

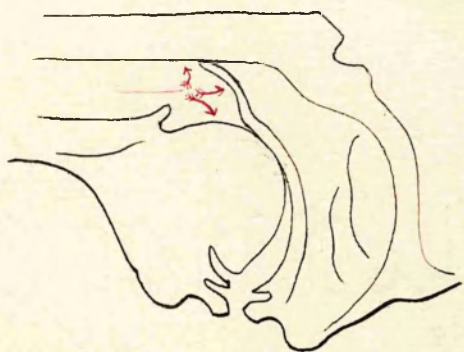


Fig. 11.

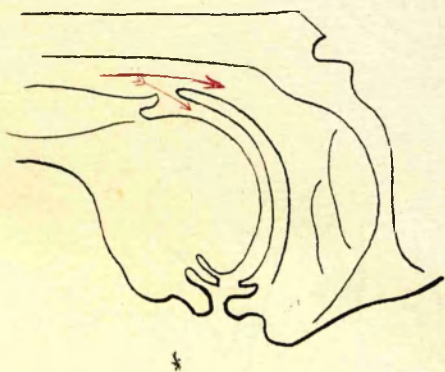


Fig. 9.

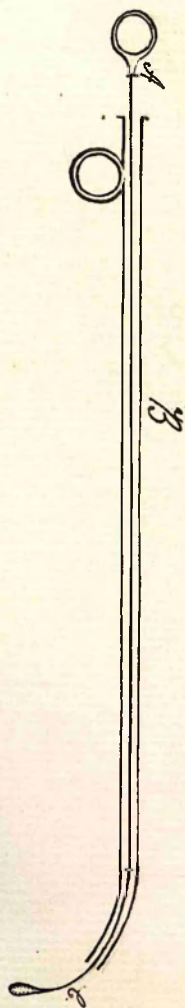


Fig. 8.

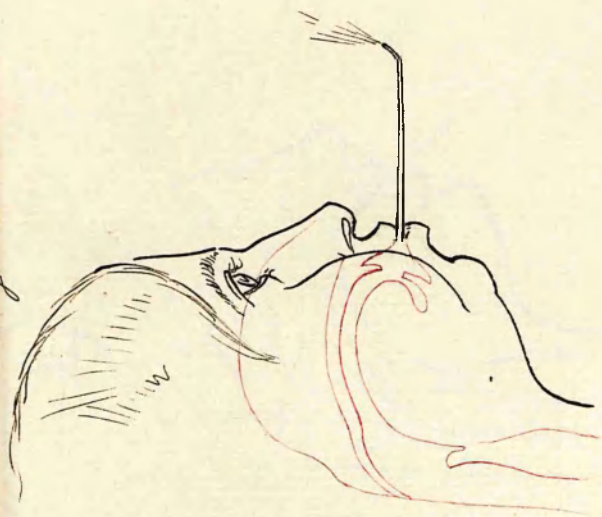


Fig. 9.

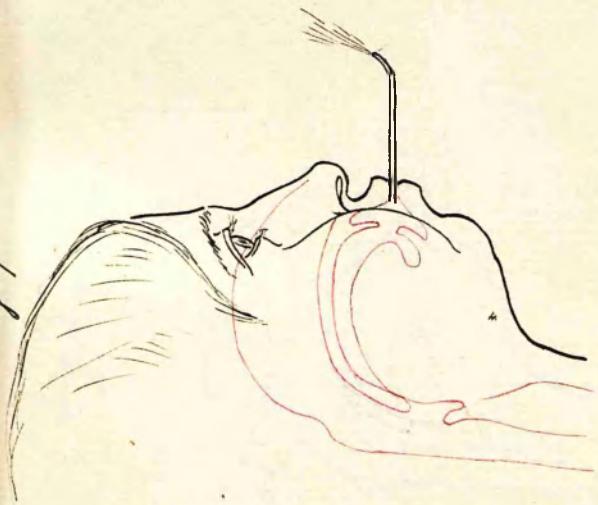
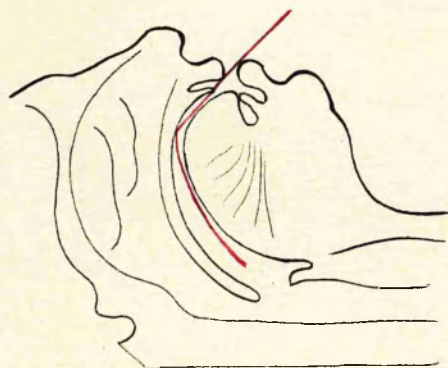
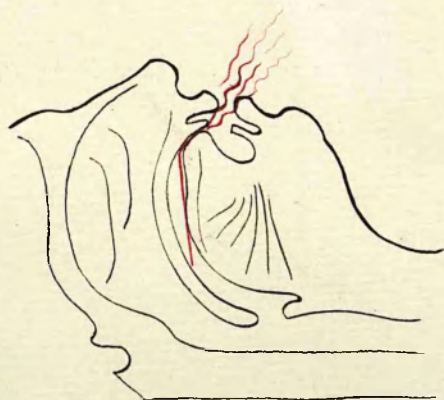


Fig. 4



" " l

Fig. 3



" " r

necessaries to produce a stammer? What must be the position of the vocal parts? What the direction and force of the air-currents? Or what parts do they impinge?

Since a stammerer can pronounce all words properly, like a normal speaker, there is no mal-
tious producing the trilling character of "r". Vigorous speakers, like the Scotch, give several well defined explosions in sounding "r" - as "rrrrr". The English characteristic is only to give one explosion, and that not well defined, while the Cockney gives it a liquid character like "w", very = vewy. The Frenchman in his terminal "r" cuts off the explosion in a sharp decisive manner as in "Notre" = Notr-. The sound of "e" is a modification of "a" - or rather we may say the vowels are all modifications of the same sound, or of one another. Being a vowel, there is no explosion. The parts are quiescent, and there is only a mellow vibration. The vowel sounds, are simply sounds caused by the vibrations of the vocal cords, and mellowed by the position of the parts, directing the air current against different parts of the vocal channel. In "oo" or "ü" against a low part of the channel, in "o" higher, then "i" next "a" and lastly "e" - So sound "oo, o, i, a, e

Pronunciation; that is to say all the parts do eventually act normally. The difficulty then does not lie in loss of power to utter the given sounds or words, but in some obstruction, causing hesitation, of a mechanical or nervous sort.

Let us deal with the latter suggestion, in the

in rapid sequence, reminds one of the sound produced in the process of filling a bottle, when near its completion. The tongue (Fig. 4) lies well forward, almost overlapping the lower teeth, and arched in the middle; the air current is projected against the front part of the hard palate. The sound represented by "ng" (Fig. 5) is got by shutting off the buccal cavity, elevating the back part of the tongue and lowering the soft palate, till the two touch. The air current is directed against this junction forming a sound partly guttural and partly nasal. Other words might have been used as examples to shew the working of the mechanism of the vocal parts and the effect this position has upon the vibrations produced by the projected air currents - exemplified in Helmholtz's Resonators.

The vocal cords are only of service in sounding the vowels; the consonants being explosives more or less prolonged, or sudden and sounded by means of the other vocal parts alone.

first place.

That there is often an amount of, what is conventionally called nervousness associated with stammering, I do not pretend to deny; but that this nervousness is the cause, or a cause, I repudiate, - otherwise we should have stammering among the female sex - an experience, I believe almost, if not altogether unheard of and shewn further - to be improbable if not impossible.

The nervousness of girls and women is as great as that of the opposite sex, yet, this does not cause females to stammer.

Our ground, therefore is limited to the narrow one of a mechanical cause or obstruction.

As we attempt the pronunciation of some letters during our trials of artificial stammering such as "g," "t," "d," "b," &c. we find that there is often no articulate sound at all produced only a muffled choking sound. This is the condition in its fullest ~~sense~~ which is the cause of stammering - the production of a muffled choking sound instead of the explosion sound of the letter, and an inability to follow it up easily with the ^{next} letter, that is the initial letter is repeated again and again, but the attempt to follow it up

with the next letter resolves itself into abortive muffled choking sounds, as in "g-g-g-great." Stammering may thus be defined as repeated abortive attempts at rapid sequence in sounding letters. When the vocal parts are set for the pronunciation of one letter, there is difficulty and delay in getting them set in position for another letter sound. There is a gap thus caused between one letter and its next. The parts once in position are fixed as it were spasmodically. and repeated attempts are necessary before they can be changed into the position necessary for the next letter. The hesitation and attempts resolve themselves into a muffled choking sound. How is it produced, what are the conditions? Of course by some obstruction to the projected currents of air.

If we close the two exits of the projected air, ^{currents} that is the nasal and buccal, the former by the soft palate. the latter, either by closure of the lips, or stuffing the tongue between the teeth, or by elevation of the posterior part of the tongue against the palate (this latter the more general) and then project the air-current at some pressure into the closed cavity of the pharynx - its elastic walls will expand under the pressure, the ^{epi-}glottis vibrating and

the nasal by.

pressure causes the deep muffled sound. *

In stammering this muffled sound is ~~repeated~~ produced between the letters - that is the sequence of the letters is interfered with by spasmodic muffling.

A non-stammerer, can produce a stammer at will by arranging the soft palate and posterior part of the tongue in proper position and thus closing the exits of the air-currents - in stammerers the same result follows from spasm of these parts, difficult to overcome.

* Note.- In using the blow-pipe, a modification of this arrangement is employed. The buccal cavity is first filled with air at a pressure, the cheeks being puffed out. The posterior opening of the mouth being now closed by the joint action of the soft palate and posterior part of the tongue - the elasticity of the cheeks causes the air to escape forcibly through the blow-pipe. The nasal passage being freely open breathing can go on through the nostrils till the buccal cavity is nearly exhausted, when the exit through the nasal passage is stopped by closure by the soft palate, and the posterior communication of the buccal cavity with the lungs, again opened, the buccal cavity is again charged with air at a pressure, breath-

The next point to be satisfied upon is the relative importance of the two passages in the production of a stammer, and consequently whether the closing of the nasal, or the buccal passage is the greater factor in the defect. The buccal passage is not necessarily closed, indeed, it is as often free as closed, and is thus a matter of indifference, but the nasal passage is invariably closed. This is evident at once by trying our artificial or voluntary stammer.

The soft palate is elevated and drawn back against the posterior wall of the pharynx. The entrance of air into the posterior nares is thus prevented. The safety-valve which would thus relieve the pressure produced by the air-currents, is closed. The pressure drives the soft palate further upwards and increases the evil. It is thus difficult

ing in the mean time being suspended. By a little practice, this change can be instantly made without any unsteadiness in the issuing stream of air - which is thus renewed again and again, and can be kept up for an indefinite length of time. Fig. 7 represents the buccal cavity closed and breathing going on through the nasal passage. Fig. 8 represents the mouth being charged under pressure, the nasal ^{in the meantime} exit closed and the breathing suspended.

for the soft palate to regain its free condition to go into proper position for the next letter. The pressure fixes and prevents it.

Instead, then of saying, that any of the vocal parts are spasmodic in their action, in producing the defect of stammering, I think it is better to consider the soft palate as first of all getting into a wrong position, then being fixed in that position with some degree of pressure. This fixation under pressure will, of course, prevent rapid changes in the position of the vocal parts, necessary to produce the sequence of letters forming the word. Forceful attempts to get out of the difficulty, will only increase it, since the pressure will be increased. We see this in stammerers when eager to communicate something of moment, the defect then comes worse upon them.

Let us now state the result of our observations, as follows -

1. Stammering does not result from organic defect.
2. It is purely a functional defect, or mechanical defect.
3. It is not a sequence of nervousness, though sometimes associated with it.
4. That it is easily produced artificially, that is

a non-stammerer can easily and ^usuccessfully imitate a natural stammerer.

5. To produce stammering, the buccal and nasal passages must be closed with some degree of pressure.
6. There is no difficulty in giving any letter-sound in this condition, but the difficulty and delay in adjusting the parts for the next letter-sound, while under this pressure, is the cause of hesitation and stammering.

Having arrived at this point, it is now the place to seek for a means of cure. Can stammering be cured? As it is a mechanical and not an organic defect, I say, Yes, at once; by adjustment of the perverted mechanism of the voice. In short, if both passages, the nasal and buccal are kept freely open - or to put it more exactly, if the nasal passage is kept freely open thus acting as a safety-valve against increased pressure, stammering would not take place, in fact, is impossible. Stammerers under my care, taught to keep the nasal passage free - speak without hesitation. The vocal parts not now working under pressure, are changed easily and rapidly into the positions required for

sequence of letter-sounds required for ~~a~~ the word to be pronounced. If the soft palate were kept in position, that is to say, not allowed to move upwards and backwards against the posterior wall of the pharynx. by some instrument, the ^{same} result would certainly follow. *

In adopting methods of cure it is best to see if some expedient can not ^{be} hit upon, easy of application, which can be applied by the pupil himself, and which shall be as naturally, logical and physiologically as possible. Let us then go back and study our stammerers again.

In the first place, we observe they have no difficulty in singing. No hesitation in giving forth musical notes. The words sung come forth rap-

* Note. I have already partially contrived such an instrument. Fig. 9. represents it. B, is the barrel of a small catheter (about gauge No 3.) A. The wine stilllette, which near the curved end is changed into a steel spring. & protected at the end by a small knob. When the spring is pushed out of the barrel by the stilllette, it has a tendency to curve downwards, and will consequently push the soft palate away from the posterior wall of the pharynx.

idly and without hesitation. How is this? Does the act of singing keep the nasal passage open and if so, how? Or is ^{it} the rhythmical vibrations that keep the parts in a ready condition?

Stammerers engaged in outdoor sports, for instance in the cricketfield, if they require to shout a message or a direction, do so without hesitation. A gentleman, now a pupil of mine, engaged to deliver an essay before a large audience. This person was a very bad stammerer, but he delivered his paper with the fluency of an ordinary speaker. Thus then there is no special virtue in singing to prevent stammering. I find if I can induce my pupils to speak with a nasal twang, in ordinary private conversation, that is as between two individuals, that there is no tendency to stammering in the speech. We have before remarked on the freedom of women from stammering - we now add those who have a nasal twang in the speech. From what we have previously said, it is easy to apprehend how a nasal twang added to the speech should relieve the tendency to stammer, because the twang is a characteristic which requires the ^{use of the} nasal passage, and consequently it must be open and free.

But how can singing relieve the tendency to stammering? It is clear, that there must be in singing a tendency to keep the nasal passage free and open. This arises from the fact that the pitch of the notes used in singing is ~~an~~ⁱⁿ average much higher than the average of spoken tones. For the same reason - the high pitch of a woman's voice takes her out of the possibilities of stammering. But how does high pitch act in relieving the tendency to stammer? The pupil, before mentioned reading an essay before an audience, by instinct, pitched his voice to the capacity of the room - The high pitch, assumed took him out of the possibility of stammering, - How?

By starting with our lowest note and running up the scale to the highest notes in our clef, and attending to the direction of the air currents - we find the lower the note, the lower down in the throat does the air current impinge. We also notice the larynx is drawn far down the throat in the low notes to allow the air-currents to impinge on the throat as far as down as possible. While when we begin to ascend the scale the air-currents impinge higher, the larynx visibly moving in a corresponding direction. We can thus produce three kinds of voices, which are convention-

ally ^{named} ~~divided~~ by musicians ~~into~~ throat voice, the lower notes of which are termed the chest voice - the mouth voice, and the nose voice, or nasal voice. These are all determined by the part of the vocal channel against which the air currents impinge.

When the air currents impinge against some part of the nasal channel a falsetto is produced. This I believe is the explanation of falsetto notes, and not by any means the influence of the false cords. Very high notes are thus falsetto of necessity. A great proportion of the notes of females are falsetto - consequent upon the high pitch of women's voices. This is the reason why women so rarely, indeed if ever, stammer. A nasal twang partakes to some extent of a falsetto, consequently a genuine Yankee with a twang has rather a high pitched voice and is seldom or never found amongst stammerers.

Stammerers are mostly found among youths whose voices are "broken", as it is called, that is in the progressive development from adolescence to manhood, the deep pitch of the voice of manhood is attained, before the body is robust enough to give the full rich quality of the adult.

We may expect Stammerers to be the opposite of burly and robust in body. Though often they have the deep pitched voice of a robust man.

To summarise again briefly - we find

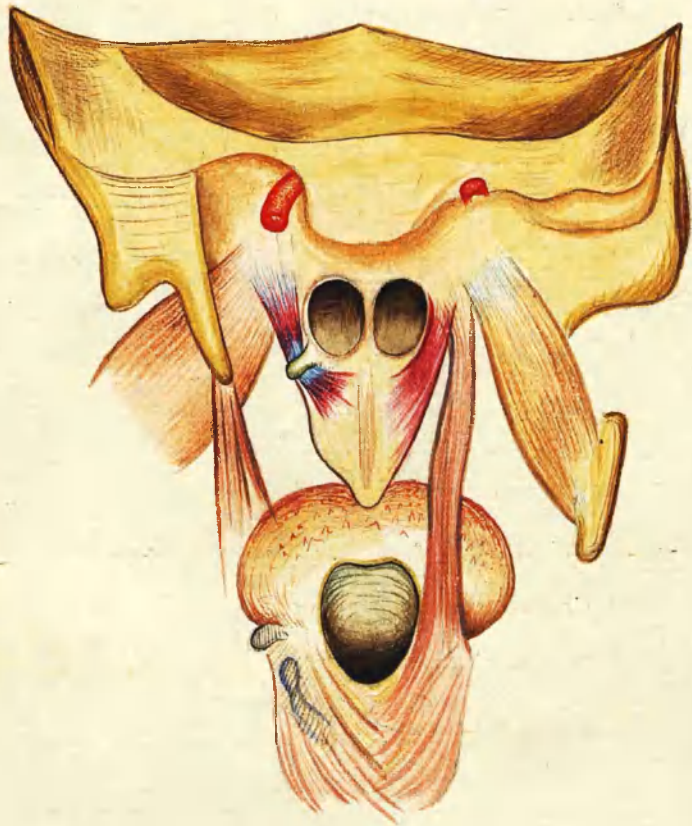
1. Women, on account of the high pitch of their voices have no tendency to stammer.
2. During the employment of falsetto (spoken) notes there is no tendency to stammer.
3. Stammerers speak below pitch - that is in a lower key than is consistent with the robustness of their ^{ages &} constitutions
4. Their voices are of the guttural or buccal type

The suggestions regarding the ways and means of cure, to be drawn from the above are simple and expedient. If our pupil can by a voluntary effort of will keep the soft palate from closing the nasal passage, nothing more is required. But, although I have found a pupil respond to my request to make sure the nasal channel is ^{made} kept free open before speaking - yet, as soon as the attention is taken up with the mechanical effort of speaking, this is forgotten and the old habit resumes. It is therefore of benefit to adopt some expedient which will not require a special and powerful exercise of

the will. This we get by raising the pitch of the pupil's voice, so that it includes in its range a portion of nasal, or falsetto notes, in other words making the use of the nasal channel a necessity. If the pupil's voice is raised - till he utters sentences freely in the falsetto tones - this is a finish step - Then if we wish the pupil to speak at an ordinary pitch it is expedient first to ask him to raise his voice to the falsetto pitch, repeat the sentence, then gradually lower the pitch down to the natural pitch - The falsetto gives the soft palate a set, which is kept up while speaking in the natural pitch, and of course there is no stammering in the speech. In this way, by first setting the pupil to repeat a phrase or a sentence in the falsetto pitch, then gradually bringing the pitch down note by note, the pupil repeats without hesitation, the sentence in any note down to the lowest guttural or chest note.

If in any of the lower notes he shows any tendency to stammer, instantly he is taken back to the falsetto, and again brought down.

Note. - The whole art of the ventriloquist consists in the employment of falsetto notes, that is, nasal in contrast to buccal and guttural. He helps out



Drawing from an original dis-
 section to illustrate the movements
 of the soft palate. In order to close
 the nasal channel, first the palato-
 pharyngeal muscles approximate
 the pillars of the fauces. The soft
 palate is next drawn upwards and
 backwards against the posterior
 wall of the pharynx, completely closing
 all communication between the throat
 and the nasal channel. The tensor
 palati, working round the hamular
 process, by keeping the soft palate tense
 keeps it from being driven out of its
 place against the posterior nares, by
 pressure underneath.

The exercises may be introduced and varied occasionally by singing the notes - and practising more especially the falsetto. Running up and down the scales is also capital practice - first in musical notes (the major) then in spoken or vocal notes (the corresponding minor key).

The condition of the patient, is also of importance. Stammerers being much subject to constipation, bilious indigestion and general sluggish habit of body.

Stammerers being reticent, and reserved on account of their defect and from the low habit of body. it is well to treat them ~~with~~ in a cheerful, lively and equable manner - and it is also of some importance to have them surrounded with cheerful and active companions.

the illusion by concealing as much as possible the effort he makes in speaking, and by assuming attitudes of listening which suggest the spot from which he wishes the voice apparently to proceed. Instead of the art, being termed ventriloquism - the art of speaking in ones belly, it is rather the opposite - the art of speaking in ones nose.